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Food & Nutrition **Research Briefs**

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Fat Replacer Reduces Fat Damage

Oatrim—a fiber-rich fat replacer made from oats—may have a role in reducing the risk of heart disease. An 11-week study found that Oatrim dramatically reduced oxidation of fatty acids in 24 men and women. Oxidation of fats circulating in the blood is believed to trigger the process that leads to blocked arteries. So a reduction in oxidation could lower the risk of heart disease. When the volunteers ate foods made with Oatrim at every meal, urinary levels of a common indicator of fat oxidation—malondialdehyde—dropped by 80 percent. This finding supports evidence that oat extracts contain substances that prevent damage to fatty acids in the body. And it suggests that substances other than the cholesterol-lowering beta glucans in oats are responsible. Volunteers had about the same drop in oxidation whether the Oatrim they consumed contained one percent or 10 percent beta glucans.

As reported earlier, eating foods containing Oatrim significantly lowered blood cholesterol and systolic blood pressure and improved glucose tolerance, which reduces the risk of diabetes. Also, Oatrim holds promise in weight reduction: Volunteers in the study lost weight despite every

effort to keep weight constant. Developed by an ARS scientist, Oatrim is in a growing number of name brand foods, and the flour-like product can be purchased commercially. *For more information, contact Judith G. Hallfrisch, (301) 344-8396, Beltsville Human Nutrition Research Center, Beltsville, MD.*

“Young Blood” From Fewer Calories

Cutting calories throughout adult life increasingly appears to reduce the diseases of aging. A study of pigs brings the evidence closer to home. The pigs were kept on a weight-maintenance diet well into old age and did not have the same deterioration in glucose and lipid metabolism that normally occurs in humans and laboratory animals as they age. Blood sugar, fat and cholesterol levels of the old animals—up to age 14—were in the same range as the young pigs. Also, levels of insulin and the many other hormones that control glucose and lipid metabolism were about the same as in the young pigs.

If given the choice, pigs keep increasing their food intake and put on more fat as they grow older. These pigs,

What We Eat In America—First Year Results From Ongoing Survey

American diets are changing in content, variety and where the foods are bought and eaten, according to data from the first year of the ongoing three-year survey, “What We Eat in America.”

Consumption of dietary fat has continued a downward trend. In 1994, fat accounted for 33 percent of total calories compared to 34 percent in the 1989-91 survey and 40 percent in the late 1970's. But two-thirds of adult Americans consume more fat calories than the 30 percent recommended. And nearly as many eat more saturated fat than recommended.

Vegetable consumption is still low, especially the nutrient-packed dark green and deep yellow vegetables. And fruit consumption has risen only 20 percent since the late 70's, mostly due to an increase in fruit juices. Nearly half the population reported eating no fruit on a given day. That's despite the dietary guidelines and education campaigns by USDA and the U.S. Department of Health and Human Services urging us to increase our intake of vegetables and fruits.

The biggest change in our eating habits has been an increase in grain products. Consumption of grain mixtures—such as lasagna and pizza—increased 115 percent in the last 17 years. Snack foods—such as crackers, popcorn, pretzels and corn chips—have soared 200 percent. Ready-to-eat cereals were up 60 percent.

“One of the biggest changes within the grain mixtures is the explosion of different ethnic foods, especially Mexican foods,” said nutritionist Lori G. Borrud, leader of the survey management team.

In 1994, survey participants reported a total calorie intake about six percent higher than 17 years ago. Thirty percent of the men and 45 percent of the women reported that they rarely engaged in vigorous exercise. This may explain why participants reported weights averaging 11 to 12 pounds heavier. Based on their reported heights and weights, one in three adults surveyed was overweight in 1994 compared with one in five in the earlier survey.

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however, were fed one-third to one-half fewer calories than they would liked to have eaten to keep them at their young adult weight. In people, that would be akin to maintaining ideal weight.

For more than 50 years, researchers have seen much longer life spans in rodents maintained on 50 to 65 percent of their preferred calorie intake. And current studies with monkeys, which are closer in their physiology and biochemistry to humans, are showing a slowing of the aging process. Now pigs—also a good model for humans—further support the evidence. Before any recommendations can be made for people, however, more research is needed to define what ideal weight really is and to develop austere diets that provide all the essential nutrients. The study was done in collaboration with the Food and Drug Administration. *For more information, contact Sam Bhathena, (301) 504-8422, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Food & Pharmacy Estrogens Prevent Clots

An estrogen-like compound in soybeans may help prevent heart attacks or strokes by keeping the clot-forming cells in a quiet state. That's the implication from a study done on rat blood. When researchers added a clot-inducing chemical to the blood, the platelets became activated and clumped together. By treating the blood with the plant estrogen, genistein, before adding the clot inducer, the researchers reduced platelet aggregation by 57 percent.

Platelets orchestrate blood clotting by enlarging and sending out projections that interlock like Velcro with other platelets to plug a breach in a blood vessel. When activated unnecessarily, these platelet clumps contribute to the debris in arterial plaques and cause a heart attack or stroke when they completely clog an already narrowed artery. The finding suggests that genistein and other phytoestrogens could prevent unnecessary clots.

Until now, the only evidence that genistein may prevent heart attack or stroke is from studies of long-lived populations, such as the Japanese, who eat a lot of soy foods in a low-fat diet. Genistein is found in soy protein products, such as tofu, miso and vegetarian burgers or hot dogs. Results of this study should prompt more research on the benefits of natural plant estrogens.

In another study, the researchers found that pharmaceutical estrogen also has a quieting effect on blood platelets. That may be one reason older women who take estrogen have a lower risk of heart disease. In the study with 16 men and 24 women ranging in age from 38 to 61, blood platelets taken from the seven women on estrogen-replacement therapy were calmer, or less activated, than those from the women who were not taking estrogen after menopause. In fact, the platelets were as subdued as those from the younger women in the study, while those from the men and older women not taking estrogen were more activated.

Researchers conducted the study to determine the effects of moderate alcohol consumption and high- or low-fat diets on risk factors for heart disease. Neither fat nor alcohol intake had any effect on platelet activation. *For more information on both studies, contact Norberta W. Schoene, (301) 504-8388, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Some Antioxidants Boost Immunity In Men

Small doses of the antioxidants beta carotene, vitamin E and selenium improved the immune response of males in a large study in China. But combinations of other vitamins and minerals either had no effect on or inhibited the ability of T cells to multiply when challenged—a test commonly used to determine how well the immune system is functioning. Among their many functions, T cells recognize cancer cells in the body and coordinate their destruction. ARS scientists tested T-cell proliferation for 400 of some 30,000 Chinese supplemented with various vitamin and mineral combinations over a five-year period. The subjects live in the Linxian region of China, where the population has one of the highest rates of cancer of the esophagus worldwide. Chinese health officials wanted to see if specific nutrients could lower risk in people who had no signs of this cancer.

Survey Results continued

Milk consumption decreased by 16 percent for children under five since the earlier survey. Meanwhile, consumption of soft drinks rose by 23 percent and consumption of non-citrus juices—such as mixes with a grape or apple base—skyrocketed more than 300 percent.

Among the women surveyed, intakes for iron, zinc, magnesium, vitamin B₆, calcium and vitamin E did not meet the Recommended Dietary Allowance. The men fell short in zinc and magnesium intakes.

In 1994, more than half of Americans ate away from home on the day in question, accounting for about one-quarter of their total calorie and fat intakes. The number of women and young children eating away from home has increased by about 50 percent since the late 1970's.

The data are based on personal interviews with about 5,500 Americans of all ages across the country, including low-income individuals, children and the elderly. The figures are average intakes, so many Americans either exceed or fall below the average.

The survey will end early next year with data on an estimated 15,000 to 16,000 Americans. It is used to make public policy decisions related to food safety, food fortification, food assistance and nutrition education programs and also for research, food production and marketing, and many other areas. *For more information, contact Lori G. Borrud, (301) 734-8457, Beltsville Human Nutrition Research Center, Riverdale, MD.*

Whenever the combination containing only 15 milligrams (mg) of beta carotene, 30 mg of vitamin E and 50 micrograms (mcg) of selenium was given, T-cell proliferation improved significantly in the males, although not in the females. On the other hand, conservative doses of vitamin A and zinc had no effect and neither did two B vitamins—riboflavin and niacin. What's more, 120 mg of vitamin C and 30 mcg of molybdenum significantly depressed T-cell proliferation, again only in the males. Researchers don't have an explanation for this adverse effect but speculate that the two nutrients may have interfered with the body's use of copper—known to be important to the immune system.

In a concurrent study, nearly 3,500 Chinese diagnosed with early signs of cancer of the esophagus got a multivitamin, multimineral supplement or a placebo daily for more than five years. ARS researchers ran T-cell tests on 400 of these subjects also and found no difference in immune response between the two groups. In both studies, the supplements did not produce a statistically significant reduction of cancer incidence and mortality. But there was a downward trend among those who got the beta carotene-vitamin E-selenium combination. *For more information, contact Tim R. Kramer, (301) 504-8459, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Fat Metabolism Needs Natural Insulin

Pregnant women who develop diabetes don't burn the fat, or triglycerides, circulating in their blood as readily as women who have normal pregnancies. So there's more fat available to the fetus, a study shows. This may explain why women who develop gestational diabetes mellitus (GDM) have large babies and thus more delivery complications, even when treated with insulin. About two to three percent of pregnant women develop GDM, which generally resolves after delivery. However these women have a higher risk of developing diabetes later in life.

It's known that insulin affects the body's metabolism of fats and amino acids—the building blocks of protein—as well as glucose. So researchers measured oxidation rates of these major nutrients in normal and GDM mothers in their last trimester and again six weeks after delivery. Although the GDM mothers were taking insulin, their fat oxidation was slower both before and after delivery. The findings strengthen evidence that diabetes is more than a disorder of glucose metabolism. *For more information, contact Nancy Butte, (701) 798-7000, Children's Nutrition Research Center, Houston, TX.*

G.I. Guard Plummets in Protein Malnutrition

Protein malnutrition leaves the intestinal lining vulnerable to bacteria, toxins and food antigens. That happens, researchers found, because cells in the lining lose much of their ability to synthesize their first line of defense—glutathione in its chemically reduced form. This finding from

a study of pigs helps explain why protein-malnourished children are so susceptible to intestinal infections and chronic diarrhea, which further decreases their absorption of nutrients. Glutathione is composed of three amino acids—the smallest units of protein. In its chemically reduced form, it serves as the body's premier antioxidant and protector against toxins and food chemicals. So researchers wanted to know how protein deficiency affects the levels of reduced glutathione and its rate of synthesis.

The most dramatic effect was seen in intestinal cells, where reduced glutathione levels were 63 percent below those in the control group, and the rate of synthesis was off by the same percent. Red blood cells followed suit, although not as dramatically, while liver cells were unaffected. When the pigs were stressed to simulate infection, reduced glutathione synthesis increased in the red blood cells but levels dropped, indicating that the cells couldn't keep up with the demand. Researchers suspect that cysteine—one of the three amino acids in glutathione—is the limiting nutrient. Although people and animals can make cysteine, apparently extra is needed in times of stress. *For more information, contact Farook Jahoor, (713) 798-7084, Children's Nutrition Research Center, Houston, TX.*

Lean Genes Weightier Than Fat Genes

The rationale for blaming body fat entirely on your genes is getting slimmer. A study of 42 families strongly suggests that the amount of muscle and other lean tissue one has is more strongly controlled by inheritance than the amount of fat. Researchers found only a weak correlation in body fat levels between mothers and their adult daughters, between fathers and adult sons and between brothers and sisters. But the correlation was significant for lean tissue, which includes bone, connective tissue, organs and body water as well as muscle.

The study is the first to look at the heritability of lean tissue in adults, and the finding runs counter to the common perception that fatness is inherited because it tends to run in families. But it makes sense, the researchers say. There's a limit to how much lean one can gain or lose. On the other hand, dietary changes and physical activity can make big differences in body fat. Inheritance may play a stronger role in the grossly obese, who were not studied.

Researchers assessed the volunteers' bone density as well as their body composition with dual energy x-ray absorptiometry (DEXA). And their findings should help settle a major question. Bone density in these volunteers was more strongly related to the amount of muscle they had than to the amount of fat, or weight. That's more good reason for adding resistance training to an exercise regimen. *For more information, contact Elizabeth A. Krall, (617) 556-3074 or 636-0885, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

A Better Tomato Through Chemistry

Tomato plants grown from tissue culture promise fruit that's sweeter, meatier and slower to rot. DNA Plant Technology Corporation (DNAP) of Oakland, CA, will field test the tomatoes under a cooperative research and development agreement. ARS scientists developed special tissue culture media unfriendly to plants with a low sugar/solids content. Those that survive in the media have enhanced sweetness, increased meatiness and extended shelf life. DNAP researchers will evaluate the consumer appeal, genetic stability and storage characteristics of the tomatoes. DNAP will also cross ARS lines with their own varieties to further improve commercial potential. These hybrids should greatly reduce production costs, maintain quality during handling and shipping and extend the fruit's shelf life. *For more information, contact ARS' George Robertson, (510) 559-5866, Western Regional Research Center, Albany, CA.*

Parasite-Free Pork

A genetically engineered protein provides a rapid and sensitive test for diagnosing in pigs the organism that causes human trichinosis. This disease is caused by eating raw or undercooked meat, generally pork, that contains the parasitic nematode *Trichinella spiralis*. The disease poses a public health risk worldwide. ARS scientists isolated a naturally derived parasite protein, called an antigen, that triggers the body's immune system to send out antibodies to fight off the parasite. In studies, the natural antigen detected 98 percent of cases in experimentally infected swine.

To improve the test, scientists have copied and reproduced the parasite's gene that makes the antigen. The improved antigen will aid the pork industry in making Trichinae-free pork available to consumers—meaning their confidence in pork products will increase. In 1985, the National Pork Producers Council estimated that being able to assure consumers of trichinella-free pork would boost domestic demand by two percent and exports by 33 percent—gains worth about \$450 million yearly to pork producers. *For more information, contact Dante S. Zarlenga or H. Ray Gamble, (301) 504-8979/8300, Immunology and Disease Resistance Laboratory, Beltsville, MD.*

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Getting "5-A-Day" a New Way

New edible coatings for fruit products made from pureed fruit will be evaluated by Alpha Food Ingredients of Evanston, IL, under a cooperative research and development agreement. ARS scientists are developing a process that combines pureed apricots, pears and peaches with various gelling agents, such as starch, to form tasty fruit pieces. The goal is to increase consumers' fruit consumption by using restructured fruit pieces as ingredients in ice cream, baked goods or other products, or as alternatives to candy. By pureeing perishable fruit at harvest time, fruit pieces can be produced throughout the year. The coating will help the fruit pieces stay moist and last longer. Alpha Foods licensed technology from Argonne National Laboratories to apply the novel high-molecular-weight polylactic acid coating to foods. ARS scientists are investigating the effects of the coatings on the color, texture and shelf life of the fruit products. *For more information, contact Tara McHugh, (510) 559-5864, Western Regional Research Center, Albany, CA.*

Thermometer Ensures Safe, Juicy Burgers

Waiting for a hamburger to turn from pink to brown is not the best way to ensure thorough cooking. A meat thermometer is the only way to be sure. In a year-long investigation by ARS researchers, results repeatedly showed that patties may be well cooked even though they are still pink. On the other hand, researchers at Kansas State University found that meat could turn brown before it reached the fully cooked temperature of 160 degrees F. Depending on color change to ensure doneness can result in overcooked, tasteless burgers or in underdone burgers that pose a food safety problem.

The different results between the two research groups may be due to the fact that KSU researchers cooked thawed meat while ARS researchers cooked patties straight from the freezer, simulating the cooking practices in school cafeterias and other food service kitchens. Also, the ARS researchers tested patties in which the fat content had been reduced to 10 percent by the addition of various fat replacers. They evaluated 17 such formulations. More than half of the formulations stayed pink after frying to the safe temperature. When the patties were left in the freezer for a year before cooking—as may happen in a school cafeteria—all but one formulation stayed pink. Studies now in progress suggest that the lack of color change is not related to fat content. *For more information, contact Brad Berry, (301) 504-8994, Meat Science Laboratory, Beltsville, MD.*

The **Research Briefs** is published quarterly by ARS Information. For further information or addition to the mailing list, contact Judy McBride, nutrition editor, at (301) 344-2861; or write me at 6303 Ivy Lane, 4th Floor, Greenbelt, MD 20770.